APPENDIX III

Formulas for the Determination of Significance Levels

Age-Specific Rates

For a given occupation and cause group, let

r_{i1} = the proportion in age group i who die, for that occupation

where $r_{i1} = \frac{d_{i1}}{n_{i1}}$ or deaths divided by population, and

r_{i2} = the proportion in age group i who die, for all **other** occupations

where $r_{i2} = \frac{d_{i2}}{n_{i2}}$.

Then the ratio of the age-specific rates (or proportions) is

$$\hat{\Theta}_i = \frac{r_{i1}}{r_{i2}}.$$

To assist large sample normality of this estimater, we take natural logarithms:

$$\ln \hat{\Theta}_i = \ln r_{i1} - \ln r_{i2}$$

which has a variance

$$V(\ln \hat{\Theta}_i) = V(\ln r_{i1}) + V(\ln r_{i2}).$$

This variance may be estimated using a linearized Taylor series approach so that

$$V(\ln \hat{\Theta}_i) \doteq \left(\frac{1}{r_{i1}}\right)^2 V(r_{i1}) + \left(\frac{1}{r_{i2}}\right)^2 V(r_{i2})$$

where $V(r_{i1}) = \frac{r_{i1}}{n_{i1}}$

and $V(r_{i2}) = \frac{r_{i2}}{n_{i2}}$,

following the Poisson distribution.

A Z-score for significance of the ratio is computed:

$$Z = \frac{\ln r_{i1} - \ln r_{i2}}{\sqrt{V(\ln \hat{\Theta}_i)}}$$

where $\ln \hat{\Theta}_i - \ln 1 = \ln \hat{\Theta}_i - 0 = \ln r_{i1} - \ln r_{i2}$

with $V(\ln \hat{\Theta}_i)$ calculated as above.

If the absolute value of this Z-score is greater than 2.57, then the rate ratio is considered significantly higher or lower than one at $p < .01$ and is flagged with one asterisk; if the absolute value of the Z-score is greater than 3.3, then the ratio is considered significantly different from one at $p < .001$ and is flagged with two asterisks.